NATIONAL INSTITUTE OF TECHNOLOGY, PATNA

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

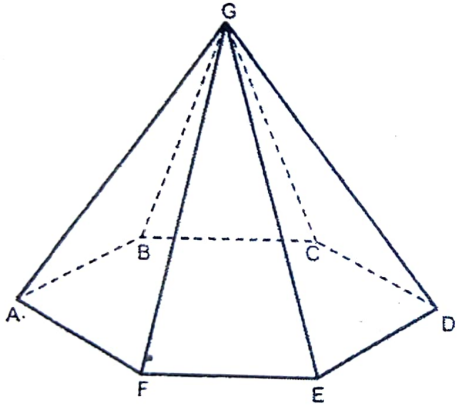
END-SEMESTER EXAMINATION – MAY 2022

B. Tech. 6th Semester CSE

Date: 12th May 2022(FN) **Time: 03 Hrs.** **Max. Marks: 60** **CS6401 – Computer Graphics**

Instructions: *It will be same as per the Exam section of NIT Patna. All the questions are compulsory.*

Ques. no.	Questions	Marks	CO	BL
Q. 1.	Define the following terms in brief with suitable diagram (if possible): (i) Interpolating and approximating curves, (ii) 3D region codes, (iii) Quadtree representation, (iv) Affine transformations, (v) Depth cueing, (vi) Center of projection (CoP), (vii) Fractal dimension, (viii) Antialiasing methods, (ix) Superquadrics, and (x) Principle Vanishing Points (PVP).	**[10*1.5=15]**	CO-1, CO-2	I, VI
Q. 2 (a)	Consider the line from (0, 0) to (4, 6). Use the simple DDA algorithm to rasterize this line segment.	**[02]**	CO-2	III, V
Q. 2 (b)	How long it will take to load a 640x480 frame buffer with 12 bits per pixel if 10^5 bits can be transferred per second? How long it will take to load a 24-bits per pixel frame buffer with a resolution of 1280x1024 using the same transfer rate?	**[03]**	CO-1	III, V
Q. 3 (a)	Proof the following in 2D transformations: (i) Prove that successive 2D rotations are additive; i.e. $R(\theta_1) . R(\theta_2) = R(\theta_1 + \theta_2)$. (ii) Prove that 2D rotation and scaling commute if $S_x = S_y$ or $\theta = n\pi$ for integral n and that otherwise they do not.	**[2*2=04]**	CO-2	II, III, V
Q. 3 (b)	Find the 2D transformation matrix that transforms the given square ABCD to half its size with centre still remaining at the same position. The coordinates of the square are: A (1,1), B (3,1), C (3,3), and D (1,3) and centre at (2,2). Also find the resultant coordinates of square and draw the respective diagram.	**[04]**	CO-2	II, III, V
Q. 4.	Differentiate between parallel and perspective projections with suitable example. Also explain the perspective projection equations in the special cases if the projection reference point could be limited to positions along the z_{view} axis.	**[04]**	CO-1, CO-3, CO-4	I, III

Q. 5 (a)	Illustrate the sequence of transformations required to rotate of a 3D object about an arbitrary axis with suitable diagram and derivate in matrix representations.	**[04]**	CO-3	II
Q. 5 (b)	Modify the two-dimensional Cohen-Sutherland line-clipping algorithm to clip three-dimensional lines against the normalized symmetric view volume square. Also explain the steps to convert a 2D object to represent it 3D transformation from world to device coordinates using 3D viewing pipeline with suitable diagram.	**[06]**	CO-2, CO-3	III, V
Q. 6.	Differentiate between Spline, B-Spline, and Bézier Curves. What are the cubic Bézier (blending) functions (Bernstein polynomials of order three) used to define the cubic Bézier curve with the help of equation in **range [0, 1]** by *t*?	**[06]**	CO-3, CO-1	IV, V
Q. 7.	Differentiate between image space and object space. Explain processing steps of Painter's algorithm for hidden surface removal. Also develop an algorithm for removal of hidden surfaces. Illustrate this on the object shown below. 	**[06]**	CO-4	IV
Q. 8.	Are you using GPU model in our normal PCs? Answer with proper justification. Also explain the benefits for using an external GPU model/card as heterogeneous computing system with suitable diagram? Also explain the GPU enabled CUDA architecture processing flow suitable suitable diagram.	**[06]**	CO-4	III, VI

*****All the Best*****